Appl. No.

10/737,315

Filed

December 15, 2003

AMENDMENTS TO THE CLAIMS

Please add Claims 30-31.

1. (Original) A dual damascene structure in an integrated circuit, comprising; a trench formed in an insulating layer;

at least one contact via extending from a floor of the trench downwardly to a conductive element below; and

a conductive lining layer along surfaces of the trench and the contact via, the lining layer having a maximum thickness of less than about 100 Å and a step coverage of greater than about 90%.

- 2. (Original) The structure of Claim 1, further comprising a metal integrally filling the lined trench and contact via.
- 3. (Original) The structure of Claim 1, wherein the conductive lining layer comprises a metal nitride layer.
- 4. (Original) The structure of Claim 3, wherein the metal nitride layer directly contacts the insulating layer and the conductive element.
- 5. (Original) The structure of Claim 4, wherein the conductive element comprises a copper line.
- 6. (Original) The structure of Claim 3, wherein the metal nitride layer comprises titanium nitride.
- 7. (Original) The structure of Claim 3, wherein the metal nitride layer comprises tungsten nitride.
- 8. (Original) The structure of Claim 3, wherein the metal nitride layer comprises tantalum nitride.
- 9. (Original) The structure of Claim 1, wherein the lining layer has a thickness of between about 20 Å and 100 Å.
- 10. (Original) The structure of Claim 1, wherein the lining layer has a step coverage of greater than about 93%.
- 11. (Original) The structure of Claim 10, wherein the lining layer has a step coverage of greater than about 97%.
- 12. (Original) The structure of Claim 1, wherein the trench has a width of less than about $0.35~\mu m$.

Appl. No.

: 10/737,315

Filed

December 15, 2003

13. (Original) The structure of Claim 12 wherein the trench has a width of less than about 0.25 μm .

- 14. (Original) The structure of Claim 1, wherein the contact via has a width of less than about $0.35~\mu m$.
- 15. (Original) The structure of Claim 1 wherein the contact via has a width between about 0.05 μm and 0.25 μm .
 - 16. (Original) A metal structure in an integrated circuit, the structure comprising: a metal runner in an upper insulating layer;
 - a metal contact extending integrally from the metal runner through a lower insulating layer; and
 - a metal nitride layer interposed between the upper insulating layer and the metal runner and interposed between the lower insulating layer and the metal contact, the metal nitride layer having a maximum thickness of no more than about 200 Å on any surface.
- 17. (Original) The metal structure of Claim 16, wherein the metal nitride layer has a thickness between about 20 Å and 100 Å.
- 18. (Original) The metal structure of Claim 16, wherein the metal nitride layer has a thickness on a bottom surface and sidewall of the metal contact that is at least about 93% of a maximum thickness of the metal nitride layer.
- 19. (Previously Presented) The metal structure of Claim 16, wherein the metal runner and the metal contact comprise the same metal.
- 20 (Previously Presented) The metal structure of Claim 19, wherein the metal runner and the metal contact comprise copper.
- 21. (Previously Presented) The metal structure of Claim 19, wherein the metal runner and the metal contact comprise aluminum.
- 22. (Previously Presented) The metal structure of Claim 16, further comprising a seed layer interposed between the metal nitride layer and the metal runner and the metal contact.
- 23. (Original) The metal structure of Claim 22, wherein the seed layer comprises tungsten.
- 24. (Original) The metal structure of Claim 22, wherein the seed layer comprises copper.

Appl. No.

: 10/737,315

Filed

December 15, 2003

25. (Original) The metal structure of Claim 16, wherein the metal contact has a depth to width ratio of greater than about 2:1.

- 26. (Original) The metal structure of Claim 25, wherein the depth to width ratio is greater than about 8:1.
- 27. (Previously Presented) The metal structure of Claim 1, wherein the conductive lining layer is formed by atomic layer deposition.
- 28. (Previously Presented) The metal structure of Claim 27, wherein the atomic layer deposition comprises:

exposing surfaces of the trench and contact via to a first reactant species to form no more than about one monolayer of material;

reacting the monolayer with a reducing species; and

reacting a second reactant species with the monolayer after reacting the monolayer with the reducing species.

- 29. (Previously Presented) The metal structure of Claim 27, wherein the first reactant species comprises a halide.
- 30. (New) The structure of Claim 30, wherein the insulating layer comprises silicon oxide.
- 31. (New) The structure of Claim 31, wherein the contact via is formed in silicon oxide.